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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/912,739	07/26/2001	Pei-Haw Tsao	TS00-823	5609

7590 09/12/2002
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EXAMINER

CHAMBLISS, ALONZO

ART UNIT	PAPER NUMBER
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2827

DATE MAILED: 09/12/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/912,739

Applicant(s)

TSAO ET AL.

Examiner

Alonzo Chambliss

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 6/25/02(election).
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) 7-10 and 17-21 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6 and 11-16 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 July 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>3</u> . | 6) <input type="checkbox"/> Other: |

DETAILED ACTION

1. The request to correct filing receipt filed 10/5/01 has been fully considered and made of record in Paper No. 2.

Election/Restrictions

2. Applicant's election with traverse of claims 1-6 and 11-16 in Paper No. 5 is acknowledged. The traversal is on the ground(s) that the product and process claims are both directed to a heat spreader. This is not found persuasive because even though both the product and process claims are directed toward a heat spreader. A totally different process, which requires wire bonding, or a TAB connection between the chip and the substrate without an underfill material can make the claimed device. Wire bonding and TAB connection fall under different subclasses than flip-chip connection (i.e. solder connection) in both class 438 and 257.

The requirement is still deemed proper and is therefore made FINAL.

Information Disclosure Statement

3. The information disclosure statement (IDS) submitted on 10/9/01 in Paper No. 3 was filed before the mailing date of the non-final rejection on 9/9/02. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Drawings

4. The drawings filed on 7/26/01 have been approved by the examiner.

Specification

5. The disclosure is objected to because of the following informalities: the first and second equations used to create the four grooves at a distance from the side boundaries of the first surface of the heat spreader can not be found in the description of the preferred embodiments. Appropriate correction is required.
6. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed. The following title is suggested: " METHOD OF FABRICATING A GROOVED HEAT SPREADER FOR STRESS REDUCTION IN IC PACKAGE. "

Claim Objections

7. Claim 2 is objected to because of the following informalities: the phrase " said first surface facing said die " on line 9 is redundant to the phrase " the first surface of the heat spreader having been designated as being the side that faces a semiconductor die. Applicant is suggested to delete the phrase on line 9. Appropriate correction is required.
8. Claim 5 is objected to because of the following informalities: the word " from " is missing after the word " distance " on line 7. Applicant is suggested to delete the phrase on line 9. Appropriate correction is required.

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9. Claim 11 is objected to because of the following informalities: the word " devices " should be replace with the word -- device --. Applicant is suggested to delete the phrase on line 9. Appropriate correction is required.

Claim Rejections - 35 USC § 112

10. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

11. Claims 2, 4, 5, 14, and 15 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

12. Claim 2 recites the limitation " a package " in line 8. There is insufficient antecedent basis for this limitation in the claim.

13. In claims 4, 5, 14, and 15, the phrases " accordance with a first equation " and " accordance with a second equation " are vague and indefinite, since it is not clear what the first and second equations are and what are the factors in the equations creating the desired result applicant is making claim for.

Claim Rejections - 35 USC § 102

14. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in-

(1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the

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treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or
(2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

15. Claims 1-3 and 6, insofar as definite, are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Braasch (U.S. 6,437,438).

With respect to Claim 1, Braasch teaches a heat spreader 160 (i.e. heat sink that cools a die) for a semiconductor package 100 (i.e. IC package assembly). The heat spreader 160 is provided with at least one groove 210, 220 across (see col. 1 lines 65-67 and col. 2 lines 28-30; Fig. 2). Giving the teachings of the above process, claim 1 is clearly anticipated by Braasch.

With respect to Claim 2, Braasch teaches the heat spreader 160 being a rectangular cube having two large parallel first and a second surfaces of equal surface area bounded by four interconnecting surfaces with the surface area of the interconnecting surfaces being smaller than the surface area of the first and second large surfaces by a measurable amount. The first surface of the heat spreader 160 having been designated as being the side that faces a semiconductor die 130 after mounting the die in a package 100 of which said heat spreader is an integral part (see Figs 1 and 2). Giving the teachings of the above process, claim 2 is clearly anticipated by Braasch.

With respect to Claim 3, Braasch teaches at least one groove 210, 220 comprises two grooves 210₁ and 220₁ provided at distances from side boundaries of the

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first surface, wherein the two grooves 210₁ and 220₁ intersect (see Fig. 2). Giving the teachings of the above process, claim 3 is clearly anticipated by Braasch.

With respect to Claim 6, Braasch teaches forming a number of grooves 210 and 220 by cutting into the surface of the heat spreader 160 (see col. 2 lines 60-62). It is inherent that when providing at least one groove across the first surface of the heat spreader a method of machining (i.e. using a saw with a blade) incorporates cutting into the surface of the heat spreader. Giving the teachings of the above process, claim 6 is clearly anticipated by Braasch.

Claim Rejections - 35 USC § 103

16. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

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17. Claims 4 and 5, insofar as definite, are rejected under 35 U.S.C. 103(a) as being unpatentable over Braasch (U.S. 6,437,438) as applied to claim 1 above.

With respect to Claim 4, Braasch discloses at least one groove 210, 220 comprises four grooves 210₂, 210₃, 220₁, 220₂, wherein the first and second grooves 210₂, 210₃ of the four grooves intersect the third and the fourth of the four grooves 220₁, 220₂. Braasch discloses the first and second 210₂, 210₃ of the four grooves and the third and the fourth 220₁, 220₂ being provided at a distance from side boundaries of the first surface (see Fig. 2). Thus, given that Braasch and the claimed invention function in substantially the same environment and with the substantially same structural grooves in the heat spreader. Therefore, the first and second grooves are formed in accordance with a first equation and the third and the fourth grooves are formed in accordance with a second equation would be inherent in the device of Braasch, lacking any disclosure to the contrary.

With respect to Claim 5, Braasch discloses at least one groove 210, 220 comprises a multiplicity of grooves 210₂, 210₃, 210₄, 220₁, 220₂, 220₃, wherein the first half of the multiplicity of grooves 210₂, 210₃, 210₄ intersect the second half of the multiplicity of grooves 220₁, 220₂, 220₃. Braasch discloses the first half of the multiplicity of grooves 210₂, 210₃, 210₄ being provided at distances from side boundaries of the first surface and the second half of the multiplicity of grooves 220₁, 220₂, 220₃ being provided at a distance from side boundaries of the first surface (see Fig. 2). Thus, given that Braasch and the claimed invention function in substantially the same environment and with the substantially same structural grooves in the heat spreader. Therefore, the first

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half of the multiplicity of grooves is formed in accordance with a first equation and the second half of the multiplicity grooves are formed in accordance with a second equation would be inherent in the device of Braasch, lacking any disclosure to the contrary.

18. Claims 11-16, insofar as definite, are rejected under 35 U.S.C. 103(a) as being unpatentable over Mertol (U.S. 5,866,943) and the Admitted Prior Art in view of Braasch (U.S. 6,437,438).

With respect to Claim 11, Mertol discloses a semiconductor device mounting support 22 (i.e. substrate), wherein the semiconductor device mounting support having a first and a second surface. The first points of electrical contact 32 (i.e. electrical bonding pads) having been provided in the first surface of the semiconductor device mounting support 22 and second points of electrical contact 34 (i.e. electrical bonding pads) having been provided in the second surface of the semiconductor device mounting support 22. One or more layers of interconnect lines 30 (i.e. trace conductor that interconnect the first and second points of electrical contacts) having been provided in the semiconductor device mounting support 22 (see col. 8 lines 33-47; Fig. 3). A semiconductor device 10 has points of electrical contact 14 (i.e. bonding pads) in a first surface of the semiconductor device. The semiconductor device is positioned above the second surface of the semiconductor device mounting support 22. The first surface of the semiconductor device faces the second surface of the semiconductor device mounting support 22. The points of electrical contact 14 provided in the first surface of the semiconductor device 10 are aligned with the points of electrical contact 32 provided in the second surface of the semiconductor device mounting support 22 (see col. 8 lines

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15-32). Electrical continuity is established between the points of electrical contact 14 provided in the first surface of the semiconductor device 10 and the points of electrical contact 32 provided in the second surface of the semiconductor device mounting support by a reflow (i.e. temperature that causing the solder balls to flow) of the points of electrical contact 14 provided in the first surface of the semiconductor device 10 (see col. 8 lines 65-67 and col. 9 lines 1-11;Fig. 3). An underfill 39 is provided for the semiconductor device 10 leaving a second surface of the semiconductor device exposed (see col. 9 lines 18-25;Fig. 3). Applying a first adhesive layer 36 over the second surface area of the semiconductor device mounting support that is not being covered by the underfill 39. A semiconductor device stiffener 24 having a first and second surface, wherein the stiffener 24 has been provided with an opening penetrating from the first and second surface of the stiffener 24 and of adequate size for insertion of the semiconductor device 10 (see col. 8 lines 48-64;Fig. 3). The stiffener 24 is positioned over the first adhesive layer 36 applied over the second surface of the semiconductor device mounting support 22. The first surface of the stiffener 24 faces the first adhesive layer 36. The opening provided in the stiffener 24 being aligned with the semiconductor device 10 mounted on the second surface of the semiconductor device mounting support 22, wherein the stiffener 24 makes contact with the first adhesive layer 36 (see col. 8 lines 48-64;Fig. 3). Applying a second adhesive layer 40, 42 over the second surface of the semiconductor device and the second surface of the stiffener 42 (see col. 10 lines 1-13;Fig. 3). A heat spreader 26 is provided with a first and second surface. The first surface of the heat spreader 26 is over the surface of the

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second adhesive layer 40, 42 (see Fig. 3). It is readily recognized to provide on the first surface of the semiconductor device mounting support with a solder mask, wherein opening in solder mask are exposing contacts points provided in the first surface of the semiconductor device mounting support. Then inserting solder balls into the openings provided in the solder mask to establish electrical continuity between the solder balls inserted in the openings in the solder mask and the contact points provided in the first surface of the semiconductor device mounting support by a process of reflow as evidence by the Admitted Prior Art (see page 8).

Mertol and the Admitted Prior Art both fail to disclose a first surface of the heat spreader having been provided with a pattern of grooves, wherein the pattern of grooves comprise of at least one groove dividing the surface area of the first surface in sections. However, Braasch discloses a first surface of the heat spreader 160 having been provided with a pattern of grooves 210, 220, wherein the pattern of grooves comprise of at least one groove 210₁ and 220₁ dividing the surface area of the first surface in sections (see Fig. 2). Therefore, it would have been obvious to substitute the heat spreader comprising grooves for the heat spreader taught by Mertol, since the heat spreader comprising grooves would dissipate heat from the semiconductor device and eddy currents generated by the semiconductor device, resulting in lower radiation emission as taught by Braasch.

With respect to Claim 12, Mertol discloses the semiconductor device mounting support 22 made of a glass substrate (see col. 8 line 12-14).

With respect to Claim 13, Braasch discloses pattern of grooves 210, 220 comprises two grooves 210₁ and 220₁ provided at distances from side boundaries of the first surface (see Fig. 2).

With respect to Claim 14, Braasch discloses at least one groove 210, 220 comprises four grooves 210₂, 210₃, 220₁, 220₂, wherein the first and second grooves 210₂, 210₃ of the four grooves intersect the third and the fourth of the four grooves 220₁, 220₂. Braasch discloses the first and second 210₂, 210₃ of the four grooves and the third and the fourth 220₁, 220₂ being provided at a distance from side boundaries of the first surface (see Fig. 2). Thus, given that Braasch and the claimed invention function in substantially the same environment and with the substantially the same structural grooves in the heat spreader. Therefore, the first and second grooves are formed in accordance with a first equation and the third and the fourth grooves are formed in accordance with a second equation would be inherent in Braasch, lacking any disclosure to the contrary.

With respect to Claim 15, Braasch discloses at least one groove 210, 220 comprises a multiplicity of grooves 210₂, 210₃, 210₄, 220₁, 220₂, 220₃, wherein the first half of the multiplicity of grooves 210₂, 210₃, 210₄ intersect the second half of the multiplicity of grooves 220₁, 220₂, 220₃. Braasch discloses the first half of the multiplicity of grooves 210₂, 210₃, 210₄ being provided at distances from side boundaries of the first surface and the second half of the multiplicity of grooves 220₁, 220₂, 220₃ being provided at a distance from side boundaries of the first surface (see Fig. 2). Thus, given that Braasch and the claimed invention function in substantially the same environment and

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with substantially the same structural grooves in the heat spreader. Therefore, the first half of the multiplicity of grooves is formed in accordance with a first equation and the second half of the multiplicity grooves are formed in accordance with a second equation would be inherent in Braasch, lacking any disclosure to the contrary.

With respect to Claim 16, Braasch teaches forming a number of grooves 210 and 220 by cutting into the surface of the heat spreader 160 (see col. 2 lines 60-62). It is inherent that when providing at least one groove across the first surface of the heat spreader a method of machining (i.e. using a saw with a blade) incorporates cutting into the surface of the heat spreader

The prior art made of record and not relied upon is cited primarily to show the process of the instant invention.

Conclusion

19. Any inquiry concerning the communication or earlier communications from the examiner should be directed to Alonzo Chambliss whose telephone number is (703) 306-9143. The fax phone number for this Group is (703) 308-7722 or 7724.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-7956.

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AC/September 9, 2002

A handwritten signature in cursive script, reading "Alonzo Chambliss".

Alonzo Chambliss

Examiner

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